Layout

1. Introduction 3
1.1. What is SimFlex™ SCL Checker Edition 2 3
1.2. The SimFlex™ tool platform 3
1.3. SimFlex™ Client Simulator 3
1.4. SimFlex™ SCL Checker 3
1.5. What is the SimFlex™ SCL Checker used for? 4
How should I use the SimFlex™ SCL Checker? 5
1.6. System requirements 5
1.7. Basic skill requirements 5
IEC 61850 standard 6
Technical Issues (Tissues) 6
UCA International Users Group testing. 6
2. Running the SimFlex™ SCL Checker the first time. 7
2.1. Start the SimFlex™ SCL Checker 7
2.2. Configure the network interface 8
2.3. Configure details about the DUT 9
2.4. Load the data model from the DUT 11
2.5. Load the SCL file (*.icd/*.cid) that belongs to the DUT 11
2.6. Select and run your first test case 13
3. Simflex SCL checker overview 14
3.1. The main application window 14
3.2. The Configuration Dialog 16
3.3. Details in the General tab 16
3.4. Details in the Devices tab 17
3.5. Details in the Conditionals tab 18
4. Use case: Configuring a test 19
4.1. Configuration for sCnf3 19
4.2. Configuration for sMdl2 and sMdl3 19
5. Use case: Running a test 20
5.1. Select and run a test case 20
5.2. Opening and examining a log file 21
6. Use Case: Running a Test Session 22
6.1. Opening a Test Session 22
6.2. Running tests in a Test Session 23
6.3. Saving and Closing a Test Session 23
7. Use Case: Request Support 24

© 2011-2014 GridClone B.V.

7.1. Using Support Feature 24
7.2. Troubleshooting Support Feature 25
8. Advanced Topics 27
8.1. How to use the data model 27
Tree hierarchy 27
How to read the values in the DUT data model (MMSData values) 27
MMSData type and length information: 27
9. Frequently Asked Questions (FAQ) 29
9.1. How to install the SimFlex™ SCL Checker? 29
9.2. I cannot connect to my device 29
10. List of possible error messages 30
10.1. Conventions used 30
10.2. Messages in sCnf1 31
10.3. Messages in sCnf2 31
10.4. Messages in sCnf3 32
10.5. Messages in sCnf4 32
10.6. Messages in sCnf5 32
10.7. Messages in sMdl1 32
10.8. Messages in sMdl2 33
10.9. Messages in sMdl3 34
10.10. Messages in sMdl4 34
10.11. Messages in sMdl5 34
10.12. Messages in sMdl6 34
10.13. Messages in sMdl7 34
10.14. Messages in sMdl8 34
10.15. Messages in sMdl9 34
10.16. Messages in sMdl10 34
10.17. Messages in sMdl11 35
10.18. Messages in all sMdl tests 35
10.19. Messages available in all tests (sCnfx and sMdlx) 35
11. Additional Topics 37
11.1. File name conventions 37
11.2. Used abbreviations 37
11.3. Referenced documents 37
11.4. Referenced tools 37
11.5. Document Version History 37

© 2011-2014 GridClone B.V.

1. Introduction

SimFlex™ is a software tool platform for testing and simulating Intelligent Electronic Devices (IED) that are based on the IEC 61850 standard.

This manual describes how to use the *SimFlex™ SCL Checker Edition 2* (*"SCL Checker"* in short). Note that there is also a *SimFlex™ SCL Checker Edition 1* available.

For the installation of the *SimFlex™ SCL Checker* please read the "Getting Started" manual.

1.1. What is SimFlex™ SCL Checker Edition 2

SCL is an XML based language defined in IEC 61850-6. It can be used for:

1) describing the capabilities of an IED (*.icd)
2) describing the configuration of an IED (*.cid)
3) describing the configuration of a system (*.scd)
4) describing the system specification (*.ssd)

The SCL Checker is designed to test .icd and .cid files against the accompanying IED and the standard.

SCL Checker is one of the tools from the *SimFlex™* family. The SCL Checker implements all sCnfx and sMdlx test cases defined in the document *"Conformance Test Procedures for Server Devices with IEC 61850-8-1 interface, Edition 2, Revision 1.0"* from the UCA® International Users Group.

1.2. The SimFlex™ tool platform

SimFlex™ is a group of tools developed by GridClone. Some tools within the *SimFlex™* family of tools have been developed for testing an IED or system against the IEC 61850 standard. Versions are available for Edition 1 and Edition 2.

Edition 1 is solemnly based on IEC 61850 with all parts from the edition ':2003'.
Edition 2 is as much as possible based on IEC 61850 with parts from the edition ':2007A' or better.

When not specified, Edition 2 is used.

1.3. SimFlex™ Client Simulator

SimFlex™ Client Simulator, both Edition 1 and Edition 2, is a tool developed by GridClone. The *Client Simulator* is used for conformance testing an IED, during a test also called the DUT (Device Under Test), as specified in the *"Conformance Test Procedures for Server Devices with IEC 61850-8-1 interface, Edition 2, Revision 1.0"* from the UCA® International Users Group. This document is based on the abstract test cases that are defined in the IEC 61850-10.

1.4. SimFlex™ SCL Checker

SimFlex™ SCL Checker, both Edition 1 and Edition 2, is a tool developed by GridClone. In this document, with "*SimFlex™ SCL Checker*" it is about the Edition 2 version. The *SCL*

© 2011-2014 GridClone B.V.

Checker is used for conformance testing of an SCL (*.icd/*.cid) file as specified in the *"Conformance Test Procedures for Server Devices with IEC 61850-8-1 interface, Edition 2, Revision 1.0"* from the UCA® International Users Group. This document is based on the abstract test cases that are defined in the IEC 61850-10.

The *SCL Checker* is an easy to use tool with advanced capabilities that enables utilities, manufacturers, system integrators and conformance test laboratories to automatically test IEC 61850 enabled devices. The *SimFlex™ SCL Checker* comes with a set of test cases that implement all the IEC 61850 test cases. The test cases can be individually selected and executed. The *SCL Checker* is easy to use and its intuitive user interface enables to quickly perform tests. The *SimFlex™ SCL Checker* is a companion tool of the *SimFlex™ Client Simulator*, meaning that together with the *Client Simulator* the *SCL Checker* can be used to test an IED and its SCL file on conformity to the IEC 61850 standard.

This makes the *SimFlex™ Client Simulator* an excellent software solution for the electrical power industry.

1.5. What is the SimFlex™ SCL Checker used for?

The main goal of the *SCL Checker* is to make the conformance testing as automatic as possible and cover all tests specified by the UCA® International Users Group on the device and the SCL (*.icd/*.cid) file. Tests defined by the UCA® International Users Group are:

Configuration file	Data Model
sCnf1	sMdl1
sCnf2	sMdl2
sCnf3	sMdl3
sCnf4	sMdl4
sCnf5	sMdl5
sCnf6	sMdl6
sCnf7	sMdl7
sCnf8	sMdl8
sCnf9	sMdl9
	sMdl10
	sMdl11
	sMdl12
	sMdl13
	sMdl14

Not all tests are fully automatic; sCnf1 (validating sSCL (*.icd/*.cid) against the schema) is also done while opening the SCL (*.icd/*.cid) file, sCnf3 needs manual intervention of the test engineer to reconfigure the DUT and reloading a changed SCL (*.icd/*.cid) file and sMdl5 cannot be automated at all (this test case is declared 'deprecated' by the UCA).

© 2011-2014 GridClone B.V.

How should I use the SimFlex™ SCL Checker?

Typically the user of the *SCL Checker* is a test engineer. The *SCL Checker* is used as a tool that will retrieve information from the DUT (Device Under Test) and its accompanying SCL file (typically an *.icd/*.cid file). Each test case (sCnf1 to sCnf9, sMdl1 to sMdl14) can be executed separately or in any combination. The results are stored in a log file (per test case) and the test engineer can review the results of the tests by checking both the log file and, if applicable, the capture file with communication between DUT and the *SimFlex™ SCL Checker*.

To fully use all capabilities of the *SimFlex™ SCL Checker* the tools needs an IED and its accompanying SCL file. The IED must be accessible through a LAN connection. The log files and capture files are stored in some storage facility, by default a folder on the local hard disk.

1.6. System requirements

The *SimFlex™ SCL Checker* has the following software and hardware requirements:

- Windows 7 SP1
- 1GB of RAM or more
- 1 GHz processor or faster
- 250 MB of free hard disk space
- At least one 100 Mbit Network Interface Card

IMPORTANT: Install the *SimFlex™ SCL Checker* software using an account with administrator rights.

IMPORTANT: The license for the *SimFlex™ SCL Checker* is not supported on virtual machines.

Before installing the *SimFlex™ SCL Checker* software please make sure that you have installed Microsoft's .Net framework version 4.0 Full Profile (or better) on your computer. Without installing .Net Full Profile the *SimFlex™* installer and/or the program itself will not run properly.

The .Net Full Profile installation file can be downloaded from the Microsoft web site:

http://www.microsoft.com/en-us/download/details.aspx?id=17718

1.7. Basic skill requirements

The test engineer must have knowledge about the IEC 61850, all parts from :2003 and all parts from :2007A, relevant parts such as IEC 61850-7-4x0:2009A, relevant parts such as IEC 61400-25-2:2006, the tissues (technical issues) related to this standard and the *"Conformance Test Procedures for Server Devices with IEC 61850-8-1 interface Edition 2, Revision 1.0"* from the UCA® International Users Group.

Please take note of the fact that each part in the IEC 61850 bundle does have a edition tag like ':2003' or ':2007A' but that the IEC 61850 bundle as a whole set does not have any official edition tag on its own.

© 2011-2014 GridClone B.V.

IEC 61850 standard

The IEC 61850 can be purchased on the IEC web site. See: http://webstore.iec.ch

Technical Issues (Tissues)

Information about technical issues is available at: http://www.tissues.iec61850.com

UCA International Users Group testing.

Information about the testing procedures is available on the UCA® International Users Group website. See: http://www.ucaiug.org

Please be aware that to access certain documents on the UCA® web site, you might need to become a member of the UCA® International Users Group.

© 2011-2014 GridClone B.V.

2. Running the SimFlex™ SCL Checker the first time.

Note: Some pictures might not be identical to what you see on your screen due to OS setting, (minor) last minute, revision changes or other causes. From the picture and the text it should be clear what to do with your installation. If you are in doubt, call customer support at GridClone for help.

Running your first test with the *SCL Checker* involves some configuration steps.

We express the importance of following the steps as described below even when you are eager to start whit the SCL checker. *Not following this procedure will result in problems and a non-functional installation*. The installation procedure is described step by step with screen shots.

Some of these steps are needed only once. The information from it is stored in the program's configuration database.

Most of the information in the subsections is also available as a separate section with a more detailed explanation.

Steps involved:

- Start your copy of the *SimFlex™ SCL Checker*
- Configure the network interface
- Configure details about the DUT (Device Under Test)
- Load the data model from the DUT
- Load SCL (*.icd/*.cid) file that belongs to the DUT
- Select and run your first test

2.1. Start the SimFlex™ SCL Checker

Locate the *SimFlex™ SCL Checker* icon on your desk top or in your Start menu and (double) click on it. The main screen of the program will open.

The Desktop Icon on top, right, the menu icon left of it and the main screen below.

Figure 1 *SimFlex™ SCL Checker* links

Enter or change the name of test engineer that will use the program for testing

© 2011-2014 GridClone B.V.

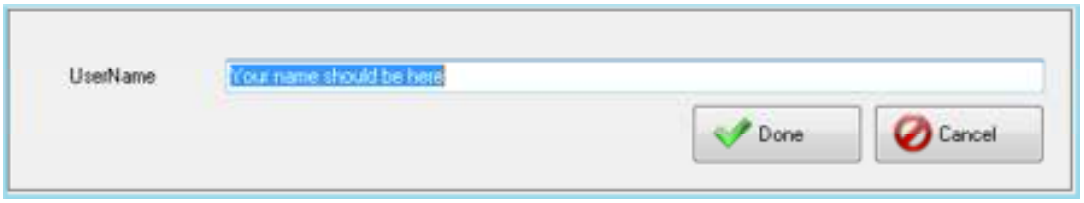

Figure 2 Log on procedure

Press **[Done]** when ready.

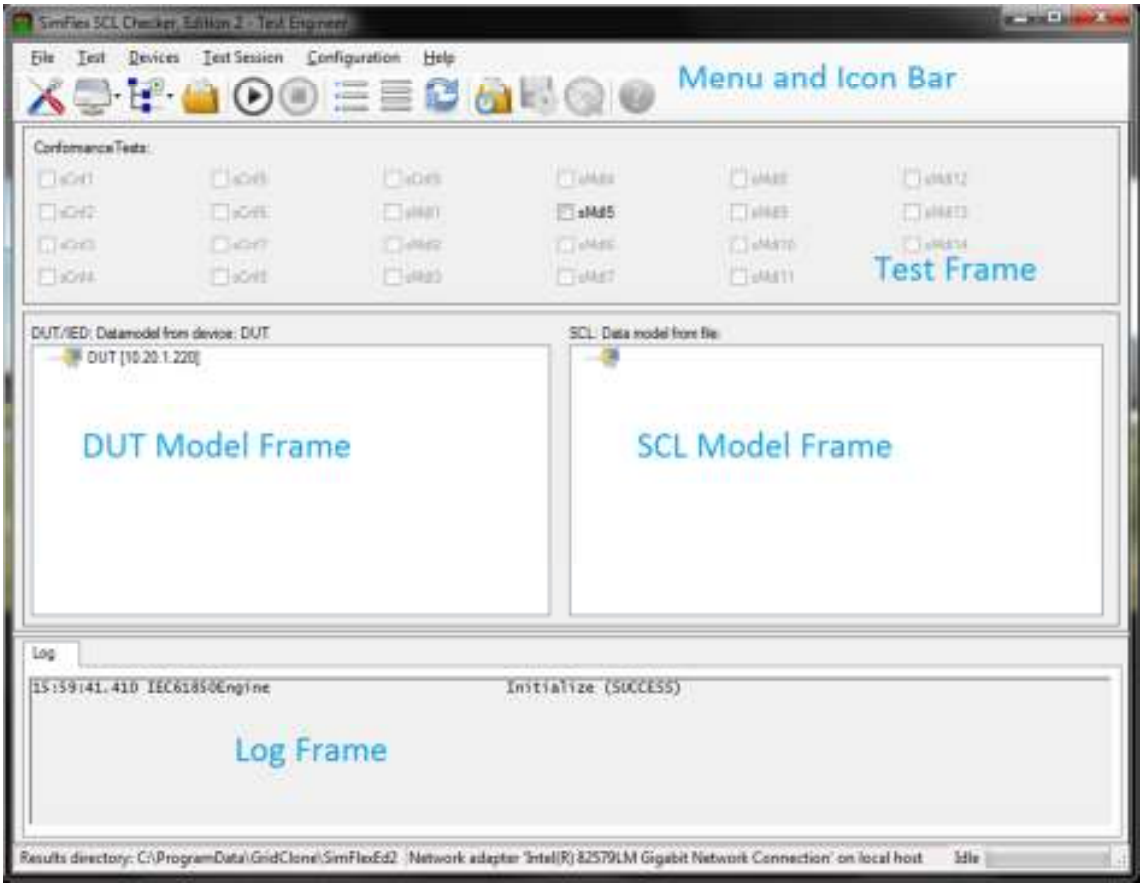

Figure 3 *SimFlex™ SCL Checker* Main screen

2.2. Configure the network interface

The next step is to configure the *SimFlex™ SCL Checker* to use the correct IP information for connecting to the DUT.

Click on the Configuration Icon (shown left) in the icon bar and select the **[General]** tab in the opening form (shown below).

© 2011-2014 GridClone B.V.

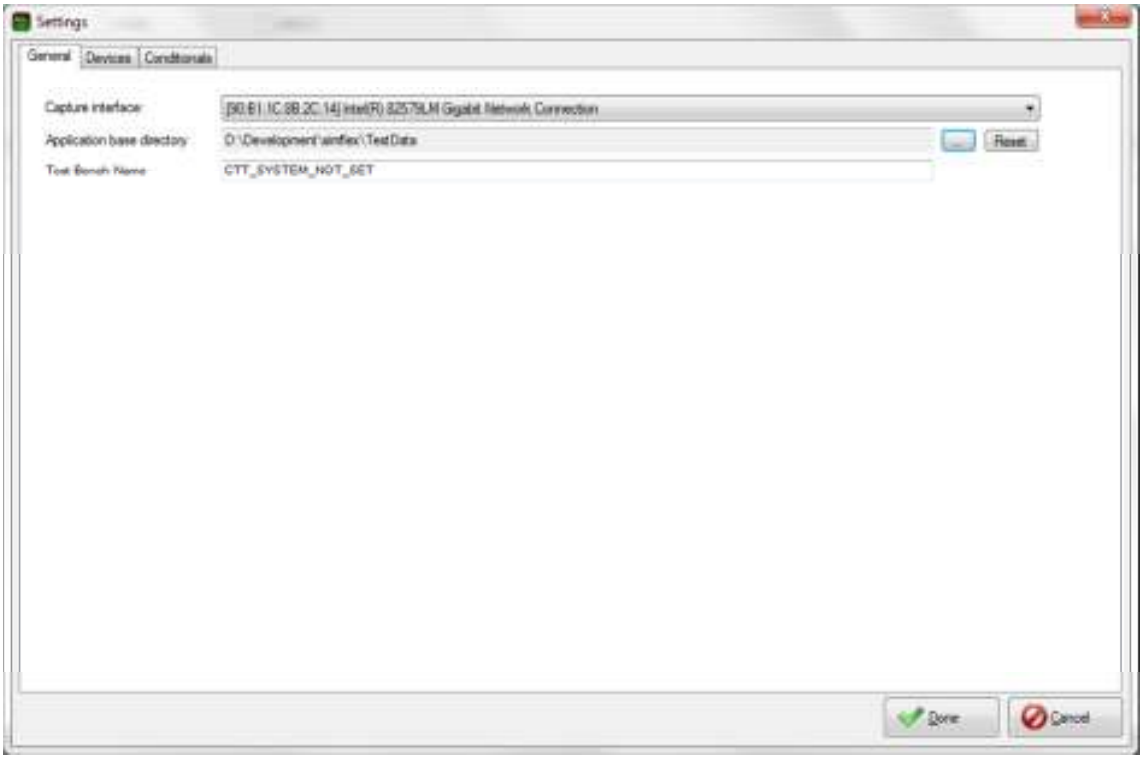

Figure 4: Selecting the NIC (Network Interface Card)

Select the network interface that you want to use for communication with the DUT.

Press the **[Done]** button when ready.

2.3. Configure details about the DUT

This needs to be done only once per model. Use the **Devices → Add Device** menu entry to open the device form. You can also use the **[Device] → Add Device** icon for that.

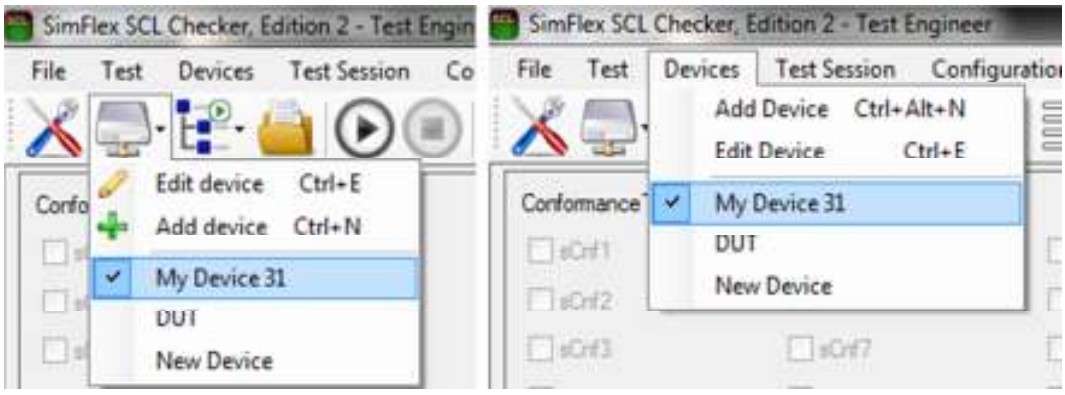

Figure 5: Open the Device Configuration dialog

The device form shows all the details, only a few are needed for a Quick start.

© 2011-2014 GridClone B.V.

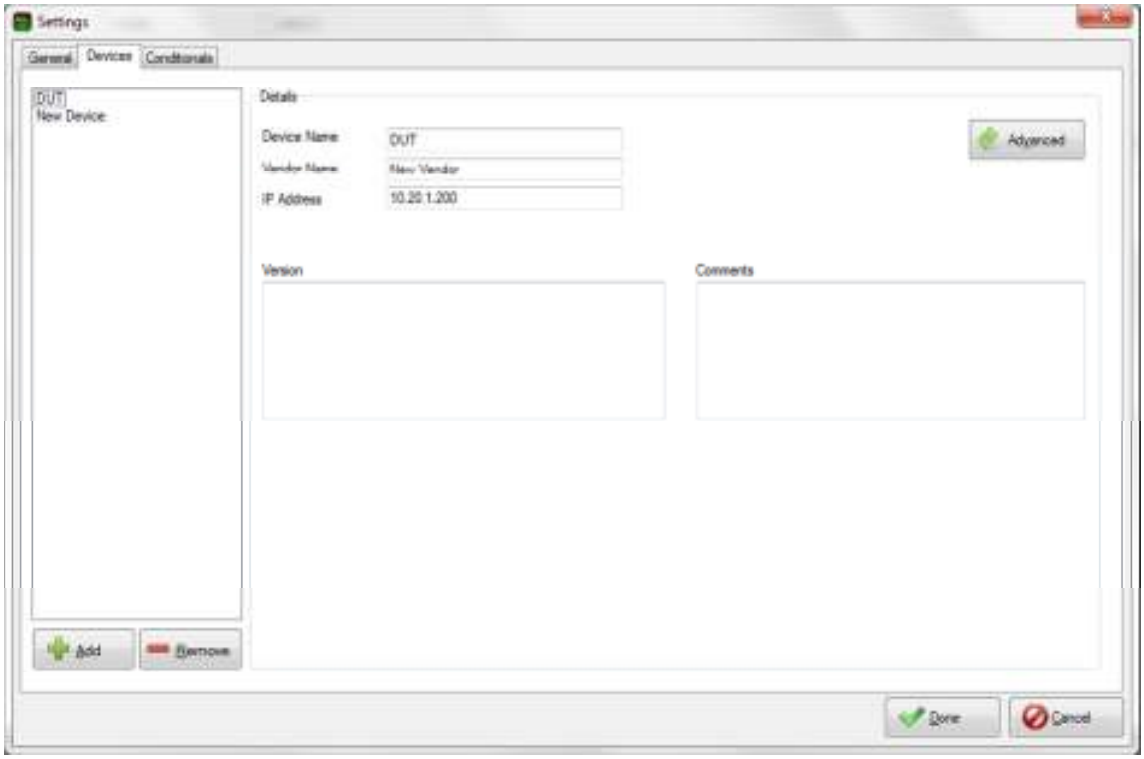

Figure 6: Device configuration.

Fill in a device name and fill in the known IP number for the device.bClick **[Done]** when ready.

After all details are filled in you can select your decvice via the **[Devices]** menu or the **[Device]** icon.

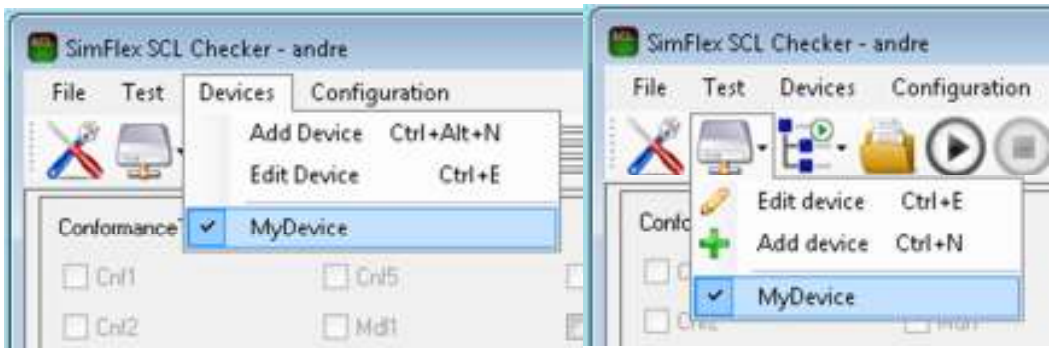

Figure 7: Select a device

You can see which device is selected on the left side of the screen, in the DUT frame.

Figure 8: The DUT frame shows which device is selected

© 2011-2014 GridClone B.V.

2.4. Load the data model from the DUT

Once you have configured and selected your device in *SimFlex™ SCL Checker* you can connect to it and let the program build a data model for it. This data model will become available to you in the data model frame. While building the data model the log frame at the bottom will inform you about the progress.

Use the **[Data model]** → **Build data model** icon in the tool bar to retrieve the data model from the DUT. There is no menu item to start this.

Figure 9: Build a data model

You can right-click on the device name in the DUT frame and select **[Build data model]** in the popup window.

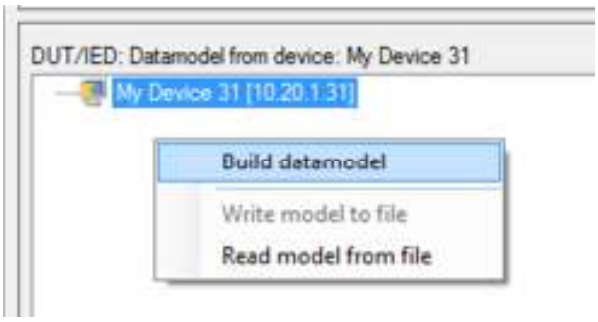

Figure 10: Build a data model

After building the model you should see a model icon in the data model frame, indicating that information about the data model is available.

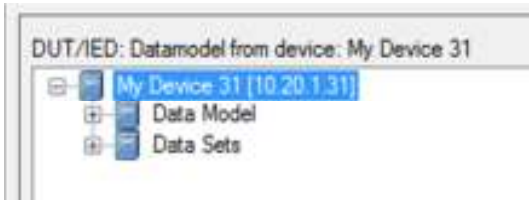

Figure 11: Data model retrieved from the DUT

2.5. Load the SCL file (*.icd/*.cid) that belongs to the DUT

Most of the validation by the *SimFlex™ SCL Checker* is not done with the DUT but with the SCL file describing the DUT, its capabilities and configuration. This file must be loaded as well. Use the **[Open configuration file]** icon or right-click on the SCL model frame and select **[Build data model]** to start loading it.

© 2011-2014 GridClone B.V.

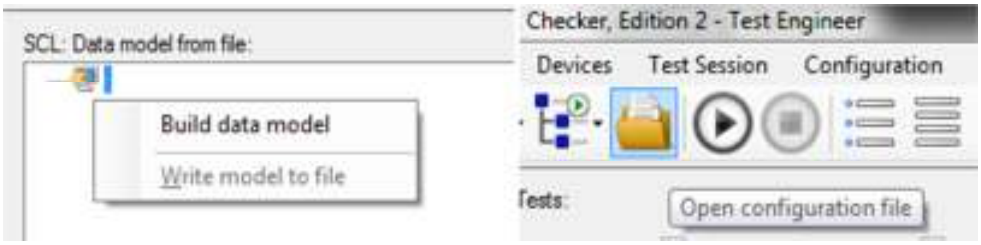

Figure 12: Open SCL file of the DUT.

A file selector window will open to enable you to select the correct SCL file (*.icd/*.cid).

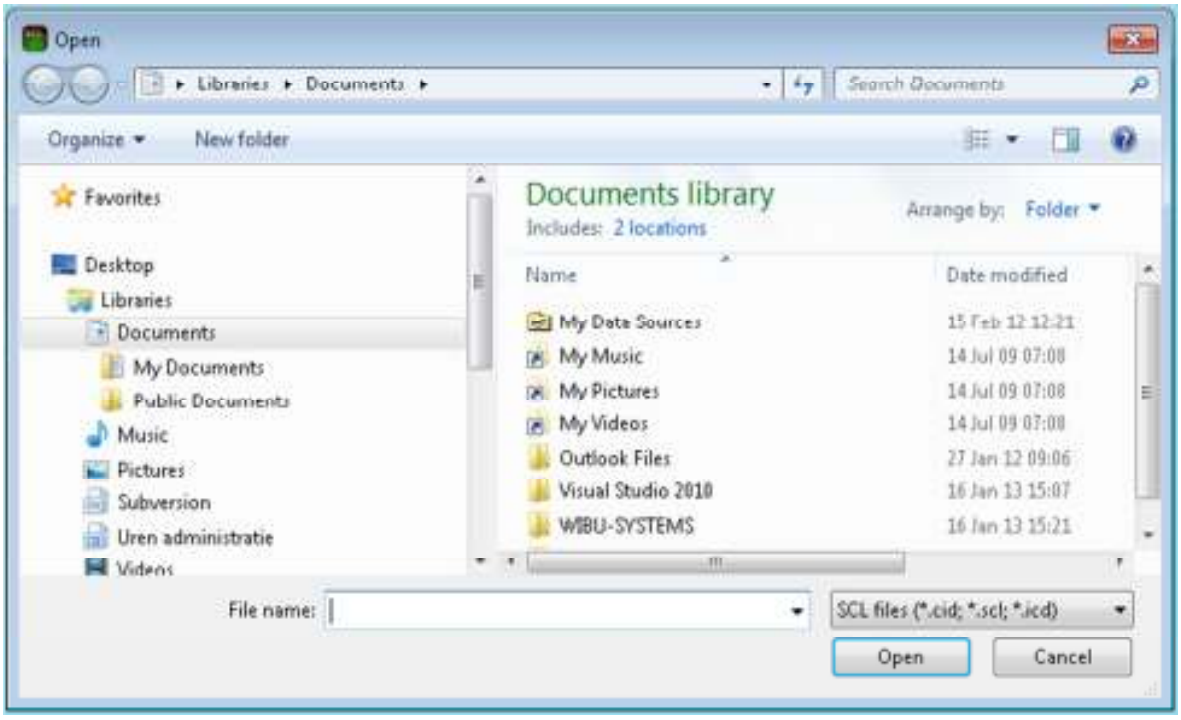

Figure 13 File selector window

Select the correct SCL file and click **[Open]**.

When the file is loaded a data model will be built from it and will be shown in the SCL model frame.

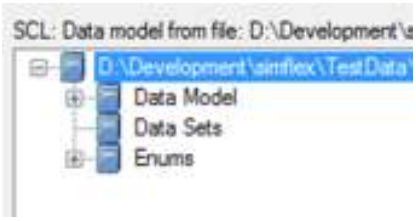

Figure 14 SCL data model

© 2011-2014 GridClone B.V.

2.6. Select and run your first test case

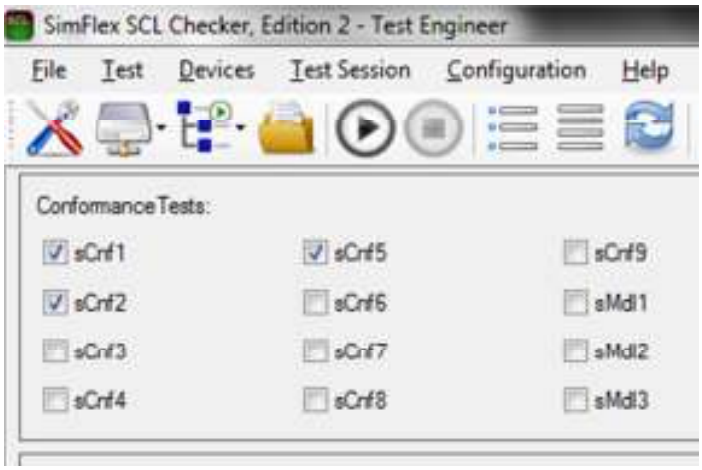

Figure 15: A selected test case

When both DUT model and SCL model are loaded all test cases are available. Select sCnf2 as the first one to run (sCnf1 is a 'formal' test, already failing when the SCL file cannot be loaded.) You are now ready to run the sCnf2 test. Do so by clicking on the **[Run]** icon (See picture below, left side.)

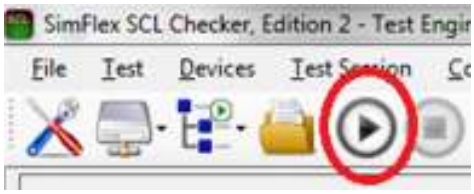

Figure 16: Start and stop a test

Push the button to start the test. The **[Run]** icon is disabled during the test.

© 2011-2014 GridClone B.V.

3. Simflex SCL checker overview

This section describes the components that are visible in the main screen of the *SimFlex™ SCL Checker*.

3.1. The main application window

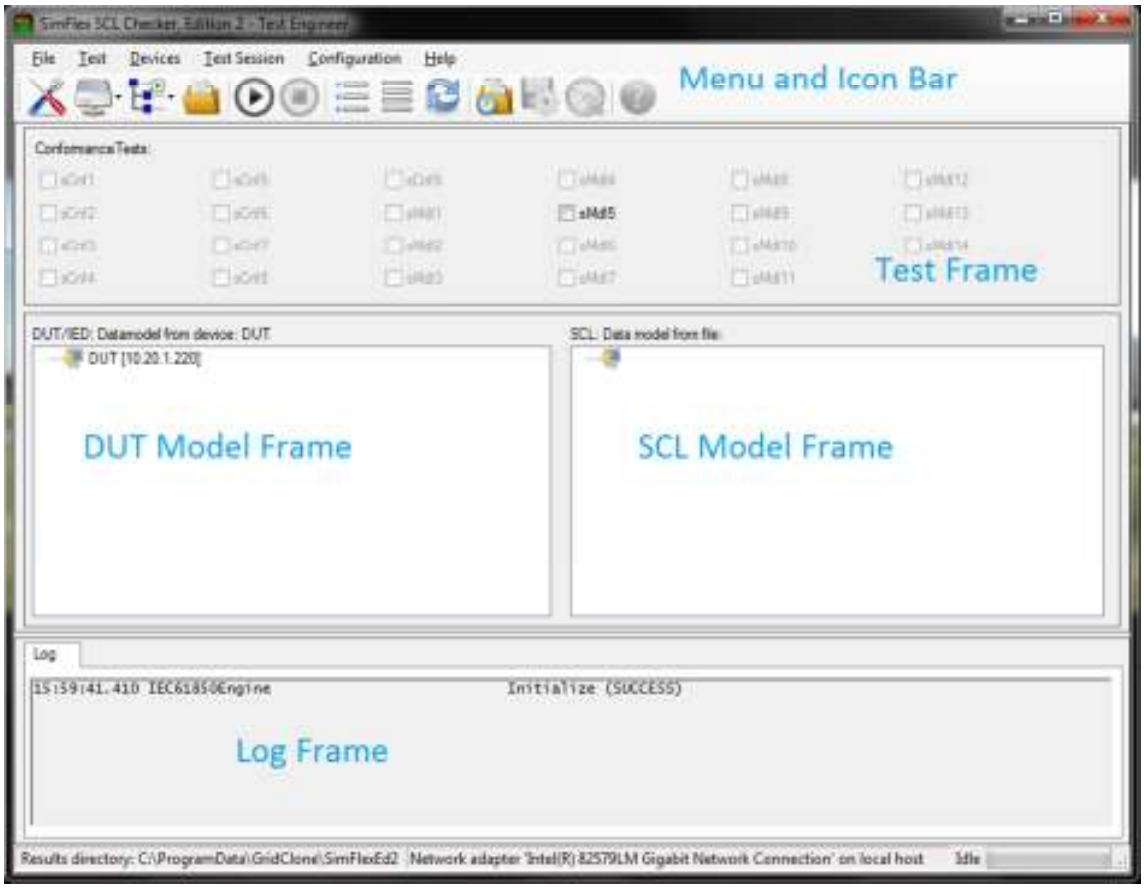
File Test Devices Test Session Configuration Help
Menu and Icon Bar
ConformanceTests
Test Frame
DUT/IED: Datamodel from device: DUT
DUT [10.20.1.220]
DUT Model Frame
SCL: Data model from file
SCL Model Frame
Log
15:59:41.410 IEC61850Engine Initialize (SUCCESS)
Log Frame
Results directory: C:\ProgramData\GridClone\SimFlexEd2 Network adapter 'Intel(R) 82579LM Gigabit Network Connection' on local host Idle

Figure 17 Main window

The main components of the application window:

- A menu and Icon bar with (from left to right)
  - The configuration icon
  - The device icon/submenu
  - The DUT model icon/submenu.
  - The SCL (*.icd/*.cid) model icon.

© 2011-2014 GridClone B.V.

- The Run selected test icon.
- The abort test icon.
- The select all tests icon.
- The deselect all tests icon.
- The deselect and reset all tests icon.
- The open session icon.
- The save session icon.
- The close session icon.
- The Support icon

- The test case frame.
  This frame shows all tests cases (sCnf1 to sCnf5, sMdl1 to sMdl5).
  Available tests are enabled, not available tests are disabled.
  A test becomes available when the data model for it (DUT and/or SCL) has been retrieved from the DUT or the applicable SCL file has been loaded..

- The DUT model frame.
  Load the data model from the DUT by right-clicking on the frame and then select “Build data model” to build a data model with Readable information only. Select “Build data model and check RW status” for full Readable/Writable information.
  You can also use the DUT model icon/submenu for this.

- The SCL (*.icd/*.cid) model frame.
  Load the data model from the SCL file by right-clicking on the frame and then select “Build data model”, select the proper SCL (*.icd/*.cid) file in the upcoming file selector window.

- The Log and info frame.
  This frame will keep all messages, warnings and other information and communication status messages.

© 2011-2014 GridClone B.V.

3.2. The Configuration Dialog

The Configuration Dialog shows 4 tabs. Each tab contains items that can be configured. In the next parts each tab and its configuration items are displayed and described.

3.3. Details in the General tab

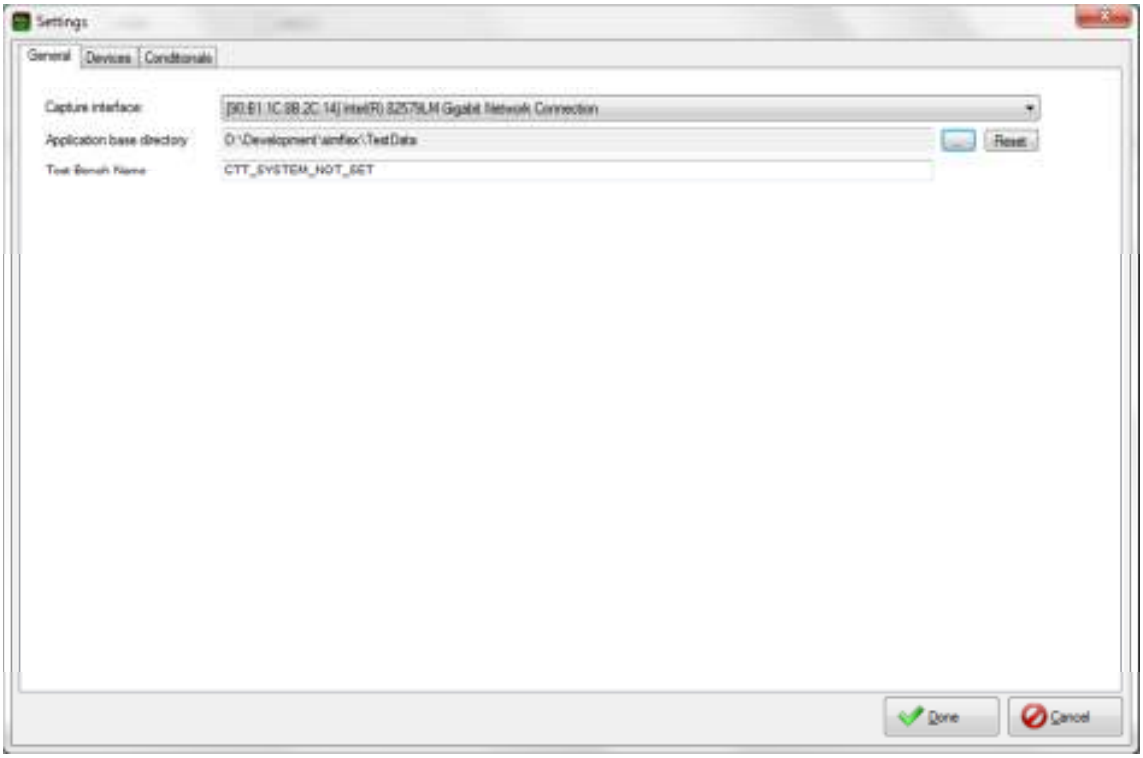

Figure 18 [General] tab for selecting the NIC (Network Interface Card) for capturing

Available items are:

- The Network Interface dropdown list.
- The “Application base directory”.

Note: This configuration item is shared with the *SimFlex™ Client Simulator*. Changing it here will also change it for the *Client Simulator*.

See also: **Error! Reference source not found.**

© 2011-2014 GridClone B.V.

3.4. Details in the Devices tab

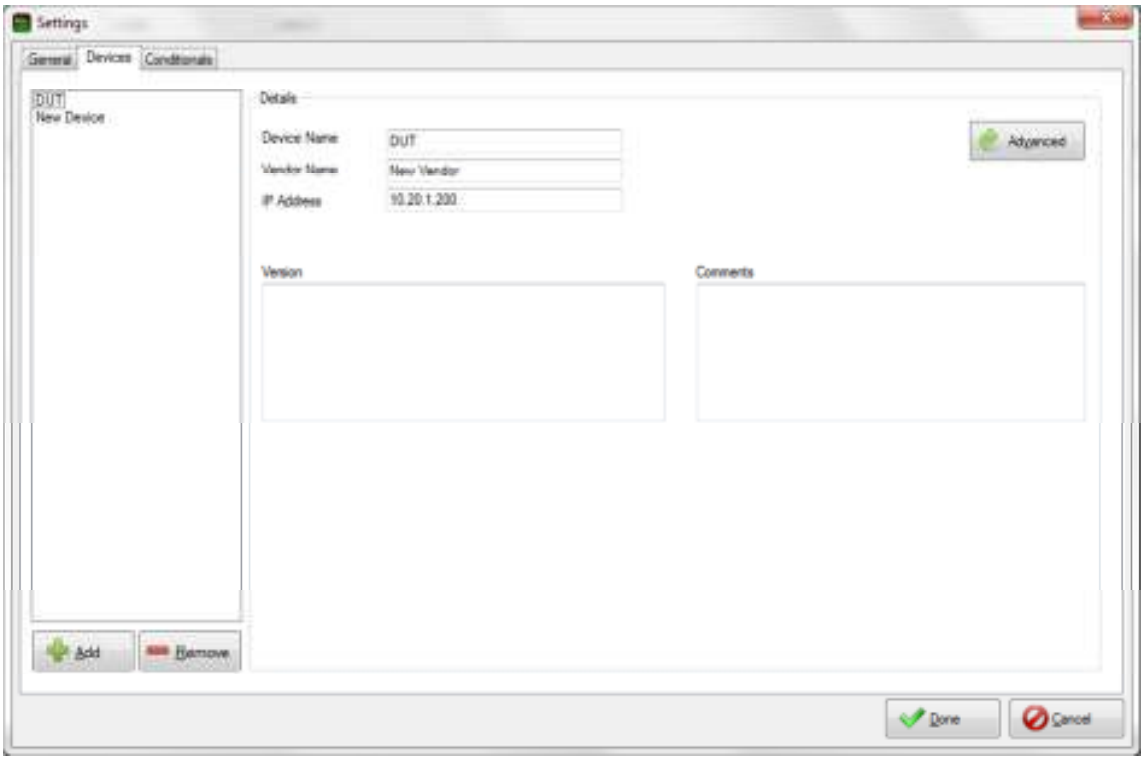

Figure 19 [Devices] tab for managing data for several DUTs

Use the **[Remove]** button to remove the selected device.

Use the **[Add]** button to add a new device/DUT.

Edit the **[Device Name]** field to reflect the name of your device/DUT.

Edit the **[Vendor Name]** field to reflect the name of the vendor.

Edit the **[IP Address]** field to reflect the IP address of your device/DUT.

Note: All settings in this tab are shared with the *SimFlex™ Client Simulator* tool.

© 2011-2014 GridClone B.V.

3.5. Details in the Conditionals tab

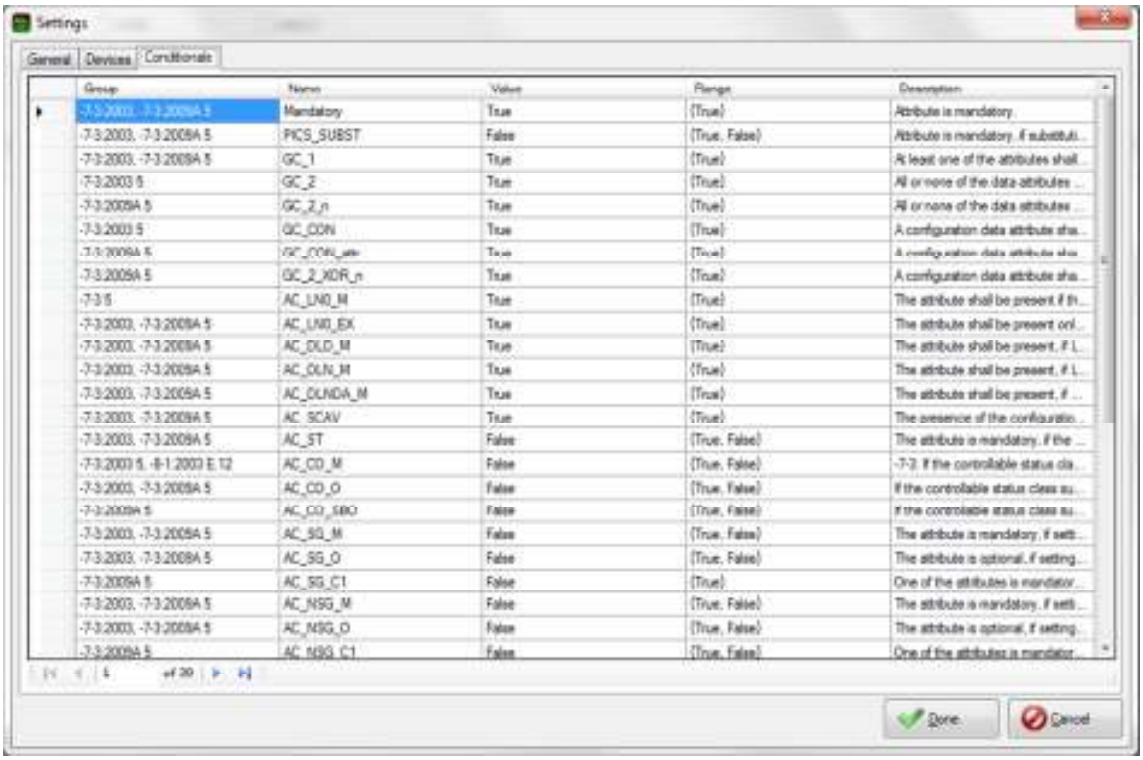

Figure 20 [Conditionals] tab for configuring PIS/PIXIT information

Description of the columns:

Group Reference to the IEC 61850 part and chapter where this condition is specified.
Fixed, for reference only.

Name Name of the condition (as described in IEC 61850).
Fixed, for reference only.

Value True (the condition is applicable) or False (the condition is **not** applicable).
Can be set to a value available in the Range column (next column to the right.)

Range Accepted values for the previous column. If only one value is available in this column then the Value column is set and fixed to this value. This column is informative.
Fixed, for reference only.

Description A description of the condition as given in the IEC 61850. This column is informative.
Fixed, for reference only.

© 2011-2014 GridClone B.V.

4. Use case: Configuring a test

Configuration for tests is only needed for sCnf3, sMdl2 and sMdl3. See the next chapters on how to configure these test cases.

4.1. Configuration for sCnf3

This test needs an additional SCL (*.icd/*.cid) file with at least five relevant changes in it. (See the UCA test description for more details).

The DUT must be configured during this test with the changed SCL (*.icd/*.cid) file and the *SimFlex™ SCL Checker* will ask the test engineer during sCnf3 to select the SCL (*.icd/*.cid) file and to reconfigure the DUT.

Please refer to the manual of the DUT how to update its configuration.

4.2. Configuration for sMdl2 and sMdl3

sMdl2 and sMdl3 check several (21) different conditions. These conditions are partly fixed and partly depending on the manufacturer. The manufacturer must supply this information through the PICS/PIXIT documents. This information must be included in the configuration's **[Conditionals]** tab.

Steps to be taken for configuring the PICS/PIXIT information:

1. Open the configuration form and select the **[Conditionals]** tab by selecting the configuration icon or selecting the menu **Configuration → Conditionals (PIXIT…)**.

2. For each line in the list, check the setting in the "Value" column.
   The "Group" column is a reference to the IEC61850 document and chapter that is applicable.
   The "Name" column is the name for the condition as used in the IEC61850 documents.
   The "Value" column is the current value (and is the only column that can be edited).
   The "Range" column sums up all acceptable values, if only one value is given then the "Value" is 'fixed' to this single value and cannot be changed.
   The "Description" column is the description for the condition as given in the IEC61850.

The configuration data for sMdl2 and sMdl3 is stored in the "Session results directory".

© 2011-2014 GridClone B.V.

5. Use case: Running a test

Before trying to run any test, be sure to have built the Device data model and loaded the SCL as specified in chapter 2.

5.1. Select and run a test case

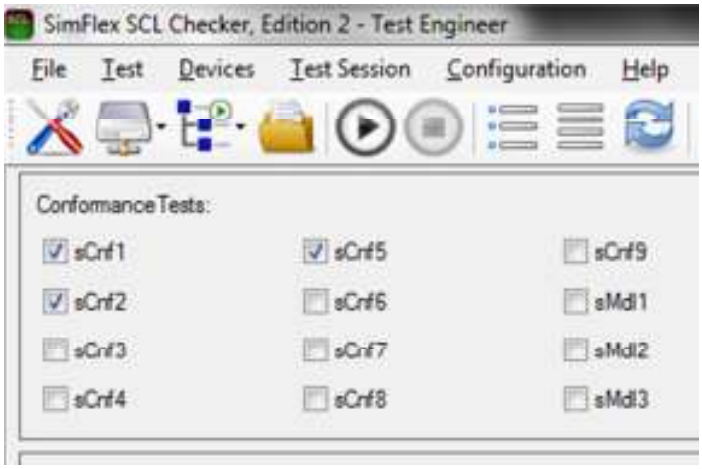

Figure 21: A selected test case

When both DUT model and SCL model are loaded all tests are enabled. Select sCnf2 as the first one to run (sCnf1 is a 'formal' test, already failing when the SCL file cannot be loaded.) You are now ready to run the sCnf2 test. Do so by clicking on the **[Run]** icon (See picture below, left side.)

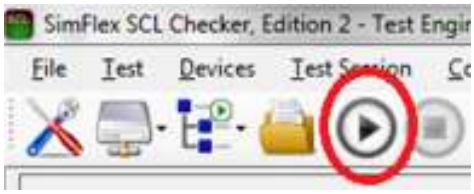

Figure 22: Start and stop a test.

Push the button and the test starts. Some things to notice are:

- The **[Run]** icon is now disabled.
- A lot of activities in the log frame at the bottom.

After a normal run the **[Run]** icon is enabled again and the test is marked as 'Passed' (green tag), 'Inconclusive' (blue question mark) or 'Failed' (red cross).

© 2011-2014 GridClone B.V.

Figure 23: Negative test result

Inspect the log for the exact reason(s) of failing.

5.2. Opening and examining a log file

A test that has already been run has an associated log file somewhere in the program data folder. The log file will be opened automatically by double clicking in test result (pass, fail or inconclusive icon).

The log file can also be opened with an external editor (e.g. Notepad). Open the location in your favourite file manager, select the file and open it with your favourite text editor.

© 2011-2014 GridClone B.V.

6. Use Case: Running a Test Session

This section explains what a test session is, how load a test session into SimFlex SCL Checker, how to run one or more tests in a session and how to evaluate the results of the run tests.

First of all, what is a test session? A test session is a compilation of a test suite and session information like DUT, test lab, vendor and settings grouped together in one file. The extension of test session files is ".tsf". Internally it is a XML file but it is not intended to be edited by the end user, instead the SimFlex CS should be used for any editing of a test session.

Note that the SCL Checker only will open and save test sessions. The user will have to use the SimFlex CS to create and modify test sessions. Refer to the SimFlex CS User Manual in order to do so.

6.1. Opening a Test Session

In order to open a test session that was previously saved, the user has several options:

1. Click in the menu bar under: ***Test Session → Open Session***, then select a test session in the *Open Test Session* dialog window.

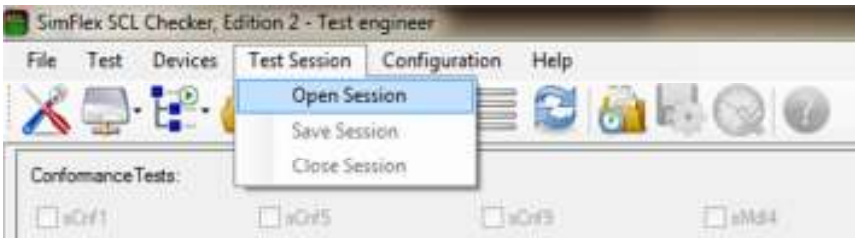

Figure 24: Open Session menu

2. Click in the tool bar button: ***Open Test Session*** and then select a test session in the *Open Test Session* dialog window.

Figure 25: Open Session button

An Open Test Session dialog window will be opened:

© 2011-2014 GridClone B.V.

Figure 26: Open Session dialog

6.2. Running tests in a Test Session

While in session mode tests can be run as specified in chapter 5.

6.3. Saving and Closing a Test Session

After modifying a session, it can be manually saved by three methods:

1) Click in the menu bar under: ***Test Session → Save Session***.

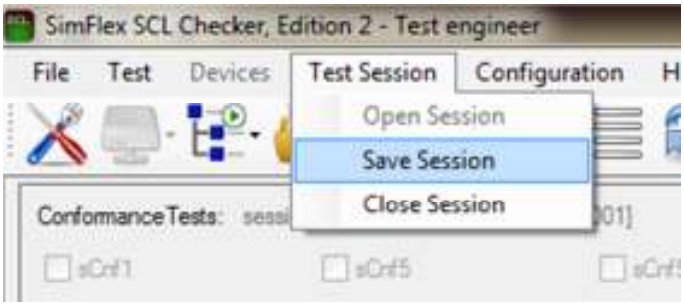

Figure 27: Save Session menu

2) Click in the tool bar button: ***Save Test Session***.

Figure 28: Save Session button

Additionally, test sessions will be automatically saved in the following cases: after a test is run, before the session is closed and before the application is closed.

The user can close a test session manually by:

1) Clicking in the menu bar under: ***Test Session → Close Session.***

© 2011-2014 GridClone B.V.

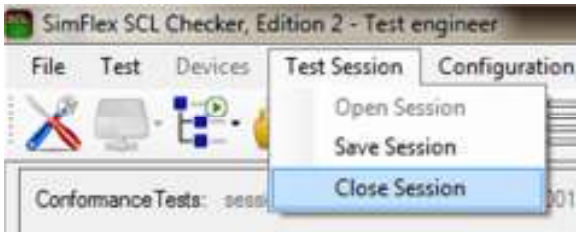

Figure 29: Close Session menu

2) Clicking in the tool bar button: ***Close Test Session***.

Figure 30: Close Session button

7. Use Case: Request Support

If you're having trouble using SimFlex SCL Checker, you can send email to GridClone. To understand the condition of your problem, GridClone needs to know the logs and configurations of your SimFlex SCL Checker application.

7.1. Using Support Feature

You can use Support feature from the application to send email for requesting support. This feature can be run by click the Support button in the icon bar. This button is available after DUT model or SCL model are loaded. While the test is running, this button will be disabled.

Follow this step to use support feature.

3. Click the Support button from the icon bar

Figure 31 Support Icon

4. A message box will appear. Click OK button.

© 2011-2014 GridClone B.V.

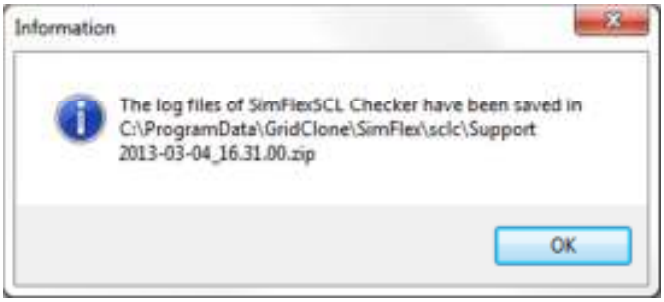

Figure 32 Message Box that shows the location of the Log files

This dialog window gives you information about the location of the log files have been saved.

5. A new dialog will appear. Click Yes button if you want send the support email.

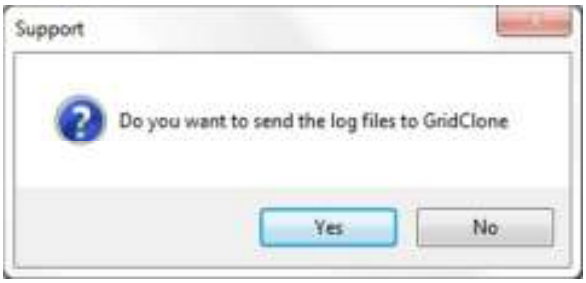

Figure 33 Dialog Window about Sending Support Email

6. Finish your email and send it to GridClone

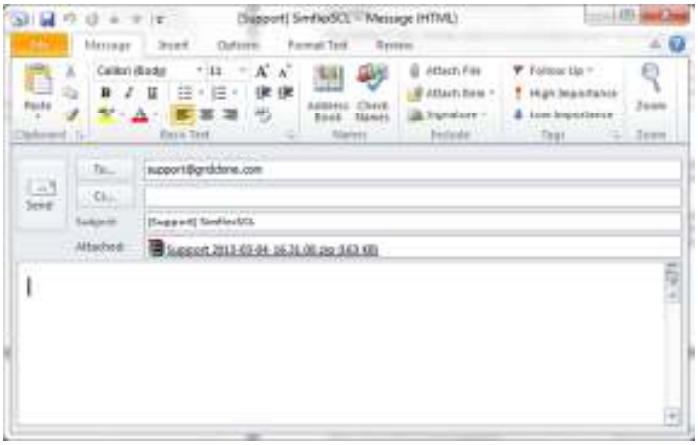

Figure 34 Composing Support Email

7.2. Troubleshooting Support Feature

This feature works if you have default mail application on your computer. However, if the email pop-up doesn't appear, you still can manually send support email to GridClone including the log files.

© 2011-2014 GridClone B.V.

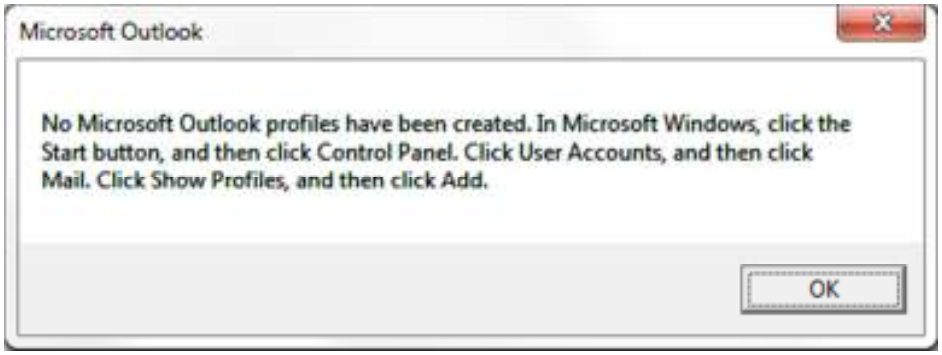
Microsoft Outlook
No Microsoft Outlook profiles have been created. In Microsoft Windows, click the Start button, and then click Control Panel. Click User Accounts, and then click Mail. Click Show Profiles, and then click Add.
OK

Figure 35 Example of Sending Support Problem

The log files are saved in a zip file. The location of this zip file is written in the previous message box and you can also find it in log frame.

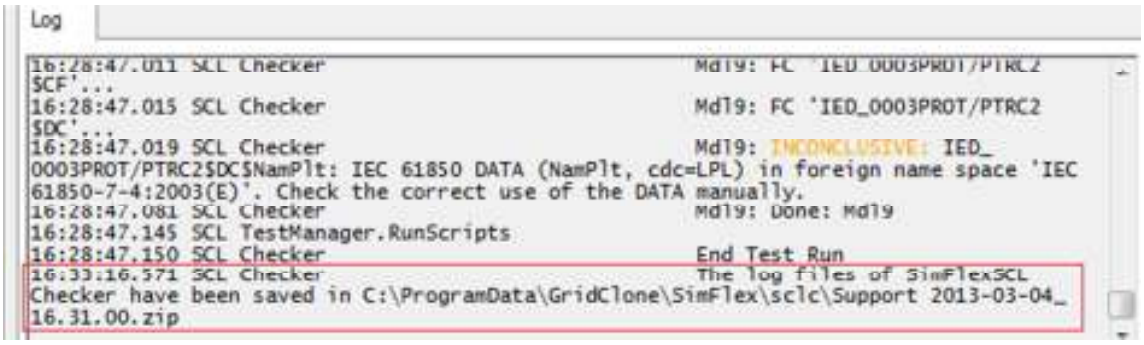
Log
16:28:47.011 SCL Checker Mdl9: FC 'IED_0003PROT/PTRC2
$CF'...
16:28:47.015 SCL Checker Mdl9: FC 'IED_0003PROT/PTRC2
$DC'...
16:28:47.019 SCL Checker Mdl9: INCONCLUSIVE: IED_
0003PROT/PTRC2DCNamPlt: IEC 61850 DATA (NamPlt, cdc=LPL) in foreign name space 'IEC
61850-7-4:2003(E)'. Check the correct use of the DATA manually.
16:28:47.081 SCL Checker Mdl9: Done: Mdl9
16:28:47.145 SCL TestManager.RunScripts
16:28:47.150 SCL Checker End Test Run
16:33:16.371 SCL Checker The log files of SimFlexSCL
Checker have been saved in C:\ProgramData\GridClone\SimFlex\sclc\Support 2013-03-04_
16.31.00.zip

Figure 36 Example of the log message that mention the location of log files

© 2011-2014 GridClone B.V.

8. Advanced Topics

This section includes more information on test cases and data models.

8.1. How to use the data model

Tree hierarchy

LD = Logical Device

LN = Logical Node

FC = Functional Constraint

DO = Data Object

DA = Data Attributes

How to read the values in the DUT data model (MMSData values)

All values from and to a DUT are communicated using the MMS protocol (ISO 9506), MMS for short, as described in IEC 61850-6. Values shown in the DUT data model are restricted to the format described within the MMS protocol.

The values displayed in the DUT data model do not only contain the MMSData type but also includes some length information, a flag indicating if the value is 'Readable', 'Writable' or both and the actual value retrieved from the DUT.

The normal format for an item with a value to is in the data model is:

Name, [MMSData type], Readable/Writable flag, value.

Example:

DUT_NAME [DUT IP address]

Data Model

LD name

FC ST

DO Mod

DA stVal, [INTEGER~8], R., value = 1

DA q, [BITSTRING~-13], R., value= [0000000000000]

DA t, [UTC_TIME], R., value = u23-11-2012_17:05:57.720

MMSData type and length information:

The length information with the MMSData type is according to IEC 61850, paragraph 8.1.1, table 14, mapping of ACSI data types.

© 2011-2014 GridClone B.V.

Most MMSData types with a fixed length (such as UTC_TIME) have no length information, with the exception of BOOLEAN. INTEGER and UNSIGNED which have length information of one digit (8 for 8 bits, 16 for 16 bits etc.). String based types (such as VISIBLE_STRING) have length information that can be negative indicating a Maximum length (the string may be shorter than the length but only if the length information is negative.). And FLOATINGPOINT values have two length information values, one to indicate the total length (in bits) and the second to indicate the length of the exponent (in bits).

Readable/Writable:

At maximum two characters indicate the data attribute readable/writable information. The possible characters are:

Character	Meaning
-	The Readable/Writable state is unknown.
.	The Readable/Writable state is untested.
R	The data attribute is Readable
W	The data attribute is Writable
w	The data attribute should be writable but is not available at the moment for writing to.

The most common combinations are:

Combination	Meaning
-	The data attribute Readable/Writable state is unknown.
.	The data attribute Readable/Writable state is untested.
R.	The data attribute is Readable but not tested for Writable.
R-	The data attribute is Readable but not Writable.
Rw	The data attribute is Readable and should be Writable but is not available for writing at the moment.
RW	The data attribute is Readable and Writable.

© 2011-2014 GridClone B.V.

9. Frequently Asked Questions (FAQ)

Some questions do reoccur and become frequently asked (that is, more than once). Check this section before you contact GridClone for support on your question.

9.1. How to install the SimFlex™ SCL Checker?

Question:

How do I install the *SimFlex™ SCL Checker* program?

Answer:

Read the *Getting started* document that comes with the program for a detailed description of the installation procedure. If you do not have **administrator rights** on your PC, please contact your IT department.

9.2. I cannot connect to my device

Question:

How can I check if my device is available on the network?

Answer:

See that your DUT is turned on and connected to the same LAN as your *SCL Checker*. Find out the IP address of the DUT.

A simple test to check if the DUT is connected and within range of the *SCL Checker* is to open a Windows Command Window (cmd.exe) and typing the following instruction at the caret:

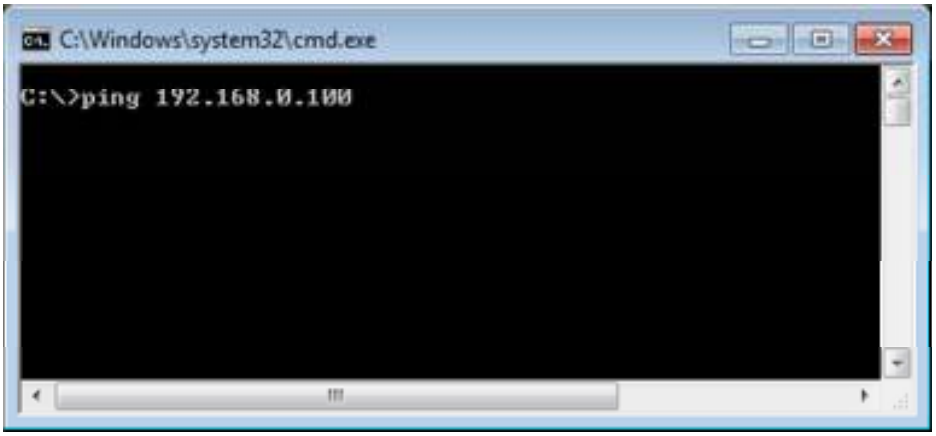

Figure 37: Check DUT network connection.

The IP address behind the *Ping* command shall be the IP address of the DUT. In case the DUT is visible it will react with positive responds.

Next, be sure that you selected the appropriate **network interface** in the **[General]** tab in the Configuration Dialog of the *SCL Checker*.

© 2011-2014 GridClone B.V.

After that be sure that you created a DUT in the **[Devices]** tab in the Configuration Dialog of the *SCL Checker*. Check if the IP address is the same as the IP address of your DUT.

Try to retrieve the data model of the DUT.

10. List of possible error messages

The *SimFlex™ SCL Checker* has three different kinds of error messages.

1) Error messages resulting from a test case
2) General error messages
3) BUG messages. (Please report these messages to GridClone).

SimFlex SCL Checker has two levels of verbosity to report messages, "Normal mode" and "Verbose mode". You can switch between the two by (de)selecting the menu **Test → Verbose** option.

In "Normal mode" (**Test → Verbose** unselected), only messages that will cause a test to fail or to be inconclusive is reported.

In "Verbose mode" (**Test → Verbose** selected) any decision made in a test is reported. This enables a test engineer to precisely follow all actions by the test and to verify not only why a test is failing but also that a test is passing for the right reasons.

WARNING: switching on the **Test → Verbose** flag will generate huge amounts of logging data and can extend the time it takes to finalize a test.

To find more information about an error message please look up the messages for a particular test and if no information is found, try the general section. These sections give details on the "Normal mode" messages. The extra "Verbose mode" messages follow a similar pattern and should be clear from the context and content alone. If not, please get in contact with GridClone.

Bug messages are clearly identified with the first (or last) word "BUG: …". In normal circumstances this kind of message will not show up but in case the program or parts of its data gets corrupted and the internal reflections and checking done by the program comes up with an unexpected, unexplainable or impossible result this message is given. Any details on how the message was triggered, what SCL files and DUT are used will be helpful to solve the problem.

10.1. Conventions used

Any message that will cause a test to fail has the word "ERROR:" at the beginning of the line.

E.g: "ERROR: line (1846, 11): DA MyLogicalDevice/LLN0COMod$Oper: Missing 'Check'"

<Line number> A position in a SCL file given as (line, column) combination.

E.g. "line (1846, 11):"

© 2011-2014 GridClone B.V.

A <*Line number*> value is normally followed by an <*Object Reference*> value. A <*line number*> is given when available and left out (including the colon) when not available. A <*line number*> refers to the line and column in the SCL file where a data object or value is specified. When data objects between the DUT model and SCL (*.icd/*.cid) file are matched then any message based on data objects from the DUT model may include <line number> information on the matched data object in the SCL (*.icd/*.cid) file. (Matching data objects between DUT and SCL (*icd) file is done on Data Object Reference only.)

<*bType*> Part of Basic IEC61850 Type information. bType is one of Int8, Int16, Enum, etc

Note: Type information in IEC61850 is defined as a (bType, type) tuple where the type part can be empty.

<*Object class*> Data object classification, e.g. “LD”, “LN”, “FC”, “DO” etc.

<*Object name*> Data object name, e.g. “LLN0”, “Mod”, “Oper”, “Check” etc.

<*Object Reference*> A value of an object reference e.g. “MyLogicalDevice/LLN0COMod$Oper$Check”

An <Object Reference> is usually preceded with a <Line number> value.

<*Result*> Any test result, one out of “PASSED”, “INCONCLUSIVE” or “FAILED”

<*Test*> Test name, e.g. “Ctl1”, “Ctl2”, … “sMdl1”, “sMdl2”,…

<*type*> Part of Basic IEC61850 Type information. ‘type’ is a further specification on the bType part, most commonly given with bType is Struct, Array or Enum

Note: Type information in IEC61850 is defined as a (bType, type) tuple where the type part can be empty.

10.2. Messages in sCnf1

sCnf1 does not generate test specific error messages. The SCL (*.icd/*.cid) file cannot be loaded in cases where this particular test would fail and as such you cannot start this test. A catch 21 situation or in another view on it: Test Ctl1 is done while loading the file.

If you cannot load a SCL (*.icd/*.cid) file, check the log window at that moment, for particular details why the file cannot be loaded. The log must include at least one line with particular information (“Line (x, y): reason of failing”) to indicate the problem where x is the line number and y is the column number in the file where the problem is located.

The actual test for sCnf1 is redone but cannot fail.

10.3. Messages in sCnf2

Message: “Missing <count> objects in SCL (*.icd/*.cid) that are referenced in data set(s).”

Meaning: A number of objects that must be available according to the SCL (*.icd/*.cid) data sets are not found in the file. This line is followed by a list of object references missing.

© 2011-2014 GridClone B.V.

Message: “Missing <count> objects in DUT that are referenced in data set(s).”

Meaning: A number of objects that must be available according to the SCL (*.icd/*.cid) data sets are not found in the file. This line is followed by a list of object references missing.

Message: “ERROR: <test part>: Found <count> element(s) in SCL (*.icd/*.cid) file which are not available in DUT model.”

Meaning: sCnf2 has four parts, checking names, types, data sets and pre-set values. In each of these parts items can be found missing. A list of object references of the missing parts is given.

Message: “ERROR: <test part>: Found <count> element(s) in SCL (*.icd/*.cid) file which are not available in DUT model.”

Meaning: sCnf2 has four parts, checking names, types, data sets and pre-set values. In each of these parts items can be found missing.

10.4. Messages in sCnf3

This test has the same messages as sCnf2. See the messages at sCnf2.

10.5. Messages in sCnf4

Message: “ERROR: Missing <count> MMS optional service(s).”

Meaning: A number of services as specified in the SCL (*.icd/*.cid) file are not available in the DUT. (A list of missing services is already given.)

10.6. Messages in sCnf5

Message: “ERROR: <number>: <object reference>.”

Meaning: A ctlModel values in the DUT is different than specified in the SCL (*.icd/*.cid) file.

10.7. Messages in sMdl1

Message: “ERROR: LNodeType <Object Name>: LD <Object Reference>: Mandatory LN not available.”

Meaning: Some mandatory data attribute is missing in a DA. Both the name of the data attribute and the object reference of the DA are given.

Message: “LNodeType <Object Name>: DO <Object Reference>: LN <object reference>, inconclusive, please check manually”

Meaning: Some DO (with given name) is unknown, possibly due to being in another name space. Please check if this LN is in another namespace and confirm the correctness of this DO not being available.

Message: “ERROR: LNodeType <Object Name>: has no mandatory DO <Object Reference>: LN <object reference>.”

Meaning: Given mandatory DO is missing from given LN.

© 2011-2014 GridClone B.V.

Message: “DO <Object Name>: SDO/DA <Object Reference>: DO <object reference>, inconclusive, please check manually”

Meaning: Some SDO (with given name) is unknown, possibly due to being in another name space. Please check if this DO is in another namespace and confirm the correctness of this SDO/DA not being available.

Message: “ERROR: DO <Object Name>: has no mandatory SDO/DA <Object Reference>: DA <object reference>.”

Meaning: Given mandatory SDO/DA is missing from given DO.

Message: “SDO <Object Name>: SDO/DA <Object Reference>: DA/Data attribute <object reference>, inconclusive, please check manually”

Meaning: Some SDO (with given name) is unknown, possibly due to being in another name space. Please check if the second SDO/DA is in another namespace and confirm the correctness of this first SDO not being available.

Message: “ERROR: DA <Object Name>: has no mandatory SDO/DA <Object Reference>: Data attribute not available.”

Meaning: Given mandatory Data attribute is missing from given SDO/DA.

Message: “Composite DA: none found in IEC61850, please check manually”

Meaning: A composite DA (structure or array) was found where the IEC61850 does not specify such a attribute. Please check if this data attribute is in another name space and the correctness of its availability.

Message: “DA <Object Name>: DA <Object Reference>: Data attribute <object reference>, inconclusive, please check manually”

Meaning: Some DA (with given name) is unknown, possibly due to being in another name space. Please check if this DA is in another namespace and confirm the correctness of the DA not being available.

Message: “ERROR: Composite DataAttribute <Object Reference>: DA <Object Name>: DA not available.”

Meaning: A composite data attribute (structure) has some missing DA..

Message: “ERROR: DA <Object Name>: Composite DataAttribute <Object Name>: DA not available.”

Meaning: A composite data attribute (structure such as a Point or a Vector) has some missing DA.

10.8. Messages in sMdl2

Messages in sMdl2 are identical as in sMdl1 but then for conditional data attributes that must be available.

© 2011-2014 GridClone B.V.

10.9. Messages in sMdl3

Messages in sMdl2 are identical as in sMdl1 but then for conditional data attributes that cannot be available.

10.10. Messages in sMdl4

Message: "ERROR: <Object class>: <Object Name> = <value>: <reason of failing>."

Meaning: A name or object reference path is too long.

10.11. Messages in sMdl5

sMdl5 does not generate error messages.

10.12. Messages in sMdl6

sMdl5 does not generate error messages.

10.13. Messages in sMdl7

Message: "ERROR: <Object Name>, <Object reference>: Type Mismatch: SCL <type>: IEC61850 <type>."

Meaning: A type in the SCL (*.icd/*.cid) model is different from the expected type.

10.14. Messages in sMdl8

Message: "DA <Object reference>: <type: Min(<value>) <= Value(<value>) <= Max(<value>). Value not in range, FAILING."

Meaning: A value is out of range..

Message: "ERROR: DA <Object reference>: <type> (Enum): Min(<value>) <= Value(<value>) <= Max(<value>). Value not in range.."

Meaning: An enum value is out of range..

10.15. Messages in sMdl9

Message: "ERROR: LN <Object reference>: At least one namespace missing. (lnNs, cdcNs or dataNs).."

Meaning: Expected at least one name space data attribute but none was found.

Message: "ERROR: LN <Object reference>: At least one namespace too much. (lnNs, cdcNs or dataNs).."

Meaning: Expected one name space data attribute but found more than one.

10.16. Messages in sMdl10

Message: "ERROR: #<index> DA <Object Name>: <Object Ref1> and <Object Ref2> are out of order with each other."

Meaning: Two DA attributes are in the wrong order..

© 2011-2014 GridClone B.V.

10.17. Messages in sMdl11

Message: "ERROR: #<index> Name <Object Name>: <Object Ref1> and <Object Ref2> are out of order with each other.."

Meaning: Two data attributes are in the wrong order..

10.18. Messages in all sMdl tests

Message: "<*Object class*>: < *Object Reference*>, please check manually"

Example: "*DO: MyLogicalDevice/LLN0EXMyDO, please check manually*"

Meaning: Information about the object reference (of given object class) is not found in the IEC61850 reference data. The object reference might be an extension or enhancement. Correction: Check that the object reference is an extension or enhancement (see PICS/PIXIT information). If not, check that the object reference is not part of the IEC61850. Depending on the test, the test engineer has to validate this object reference and adjust the outcome of the test accordingly.

10.19. Messages available in all tests (sCnfx and sMdlx)

Message: ERROR: <*Line number*>: <*Object class*> <*Object reference*>: Missing <*Object name*>."

Example: "ERROR: *line (1846, 11): DA MyLogicalDevice/LLN0COMod$Oper: Missing 'Check'..*"

Meaning: The data object 'Check' is missing in data object "MyLogicalDevice/LLN0COMod$Oper" and as such, the test is FAILING.

Message: "ERROR: parent <*Line number*>: <*Object class*> <*Object reference*>: child <*line number*>: <*Object name*>: Not allowed."

Example: "ERROR: *line (1846, 11): DA MyLogicalDevice/LLN0COMod$Oper: child (1890, 11): 'Check': Not allowed.*"

Meaning: The data object 'Check' is included in data object "MyLogicalDevice/LLN0COMod$Oper" while not allowed and as such, the test is FAILING

Message: "Start: <*test*>".

Example: "*sMdl5: Start: sMdl5*"

Meaning: Test sMdl5 has started, any log message from within the test is preceded with the <*test*> name, including this one.

Message: "Test description: <*some text*>"

Example: "*sMdl5: Test description: Verify data model mapping according to…*"

Meaning: This is what test sMdl5 is specified to do (according to the UCA).

Message: "Start Conformance test."

© 2011-2014 GridClone B.V.

Example: “*Start Conformance test.*”

Meaning: Test script initialisation is done, the actual test is starting now, any messages after this message do imply the actual test and its results.

Message: “Finished Conformance test, result: <result>.”

Example: “*Finished Conformance test, result: PASSED.*”

Meaning: The actual test is done and the final result is known. Some de-initialisation might follow to clean up test results.

Message: “Done: <*test*>”.

Example: “*sMdl5: Done: sMdl5*”

Meaning: Test sMdl5 has finished; this is the last log message from within the test, still preceded with the <test> name.

Message: “No valid SCL data from file available (test inconclusive)”

Example: “*No valid SCL data from file available (test inconclusive)*”

Meaning: You did not load any SCL file (*.icd etc) but information from it is needed for the test you selected to run.

Correction: Load the SCL file (*.icd etc) belonging to the DUT that you are testing to correct this.

Message: “No valid DUT data from model available (test inconclusive)”

Example: “*No valid DUT data from model available (test inconclusive)*”

Meaning: You did not build a data model for the DUT but information from it is needed for the test you selected to run.

Correction: Connect to a DUT and build a data model.

Message: “ERROR: <*Some text*>: Unforeseen problem.”

Example: “ERROR: divide by zero error: Unforeseen problem.”

Meaning: Due to some corrupt data, programming error or other reason not covered in testing the program has met a failing point from which it cannot recover. Due to that the test cannot continue and must fail. This message might imply a bug in the program but could as well be a bug or non-compliance condition in the DUT. Please report this message to GridClone. Any details on how the message was triggered, what SCL files and DUT are used is immensely helpful by solving the problem.

© 2011-2014 GridClone B.V.

11. Additional Topics

11.1. File name conventions

Any *.txt file is a test result file and has the same content as the log frame.

Any *.log file is an error log file for errors related to the program and not to the test.

sMdl1-2013-01-07_09.28.43-CS.txt is the test result of test case *sMdl1* generated by the *SCL Checker* on the 7th of January 2013 at 09:28 local time.

2013-01-07_09.28.43-SimFlexError.log is an error log for the same run. This file is located in the “Application base directory”.

11.2. Used abbreviations

DUT	Device Under Test.
IEC	The International Electrotechnical Commission, managing international standards. See: http://www.iec.ch/
IEC 61850	The IEC 61850:2007 standard, version A and B
IED	Intelligent Electronic Device
UCA	The UCA® International Users Group. See: http://www.ucaiug.org

11.3. Referenced documents

IEC 61850	IEC 61850:2007 version A and B
MMS	ISO 9506:2003 (as used by IEC 61850-8)
	Getting started.pdf

11.4. Referenced tools

WinPcap	For capturing network traffic, see: http://www.winpcap.org/
WireShark	For analysing network traffic, see: http://www.wireshark.org/

11.5. Document Version History

The table below describes the version history of this document.

Version	Date	By	Subject
1.0	January 1, 2013	EM	Initial version
1.1	January 22, 2013	EM	Extending on several subjects.
1.2	January 26, 2013	EM	General rework on entire document
1.3	June 20, 2013	EM	General rework for Edition 2.

© 2011-2014 GridClone B.V.